Schaefer, Heidi

From: Schaefer, Heidi
Sent: Thursday, October 27, 2016 3:29 PM
To: Crocker, Joe
Cc: Craig, Mark
Subject: FW: Action Required: Additional Information Required for Imminent Threat Assessment for IBof Salmon - Due: October 21, 2016
Attachments: Imminent Threat Assessment for the iBoF Salmon_rev Oct 4_FPP Maritimes.docx

Hi Joe,

Attached is the revised Imminent Threat Assessment with requested additional information from FPP. Please let us know if you have any remaining questions or concerns.

Thanks,

Heidi

Imminent Threat Assessment for the Atlantic Salmon, Inner Bay of Fundy populations

1.0 Issue

In May 2001, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the Atlantic salmon, inner Bay of Fundy populations (hereafter iBoF salmon), as Endangered. The Government of Canada designated the iBoF salmon as Endangered under Schedule 1 of the *Species at Risk Act* (SARA) when the Act came into force in June 2003. Following an updated status report and re-assessment by COSEWIC in April 2006 and a re-examination in November 2010, the status of the iBoF salmon was confirmed as Endangered[1].

Section 80 of SARA states that the competent minister must make a recommendation to the Governor in Council to make an Emergency Order to provide for the protection of a listed wildlife species, if the competent minister is of the opinion that the species faces imminent threats to its survival or recovery. The Minister of Fisheries and Oceans (MFO) is the competent minister under SARA for the iBoF salmon, except for the portions of critical habitat within Fundy National Park of Canada, which is administered by the Parks Canada Agency.

In the case of an aquatic species, an Emergency Order may

- identify habitat that is necessary for the survival or recovery of the species in the area to which the Emergency Order relates; and/or
- include provisions requiring the doing of things that protect the species and that habitat, or provisions prohibiting activities that may adversely affect the species and that habitat.

The section 80 provision of SARA is intended for exceptional circumstances: when irreversible harm to a wildlife species is likely to occur without immediate intervention owing to a sudden or unforeseen activity; where existing protection measures do not exist; and when the normal processes would not be completed within a timeframe to address the irreversible harm.

This document assesses the current threats to the iBoF salmon, using the best available information, with the aim of informing an opinion as to whether this wildlife species faces imminent threats to its survival or recovery in Canada, and whether an Emergency Order would be required. The assessment considers the population and distribution objectives set out in the federal recovery strategy for the species. It takes into account information on the biology and ecology of the species, threats to its survival and recovery, and its current population and habitat status and trends. An analysis of existing legislative measures that protect the species against threats from human activity is also provided. Finally, a summary of recent DFO reviews of two projects that occur in important iBoF salmon habitat are summarized, along with their conclusions.

Socio-economic impacts were not considered in the assessment, as they are not relevant to determining whether or not a wildlife species is facing imminent threats to its survival or recovery. Socio-economic considerations would inform a Governor in Council decision, further to a recommendation by the competent minister.

[1] An "endangered species" is defined under SARA as a wildlife species facing imminent extirpation or extinction.

2.0 Background

2.1 Species Biology

The life cycle of the Atlantic salmon contains many stages. Adult iBoF salmon spawn in October and November. After spawning, surviving adults ('kelts') may return to sea immediately where they continue to grow until the next spawning season or remain in the river over winter and return to sea in the spring. The eggs develop in the redd during the winter and hatch in the spring (March or April). The young remain buried in the gravel as 'alevins', absorbing the yolk sac until May or June, at which point they emerge as 'fry', and grow as 'parr' feeding on invertebrate drift. Parr become 'smolt' after two or three years in fresh water, then enter the ocean where they grow rapidly to maturity. Adults spend part of their life feeding and growing at sea (which for iBoF salmon is mainly the Bay of Fundy and northern Gulf of Maine), and then return to reproduce in the freshwater stream where they hatched. The adult stage is usually one year (a single reproductive event), although some have been known to live for up to three years. IBoF salmon are unique in that the majority of fish mature after only one winter at sea.

At maturity, they home to their river of origin. Straying rates are low, typically less than 5%. Atlantic salmon that are ready to spawn begin moving up rivers from spring through fall. Although the timing of river entry varies among populations as an adaptation to local conditions and a response to water levels, these spawning runs are surprisingly consistent, occurring at the same time each year for each river (DFO 2010).

Requirements in Freshwater

Atlantic salmon streams are generally clean, cool, well oxygenated, characterized by moderately low to moderately steep gradients, and have bottom substrates composed of assorted gravel, cobble and boulder. Salmon prefer stable stream channels that develop natural riffles, rapids, pools and flats, which are utilized during different life stages. Except in areas affected by localized pollution sources, water quality in iBoF rivers is good to excellent for Atlantic salmon production.

Requirements in Marine Waters

Marine habitat requirements for iBoF salmon are less well known than those for freshwater. The only available indicator of marine habitat quality for Atlantic salmon is temperature. The marine temperature preference for Atlantic salmon ranges between 1-13°C, with high preference for 4-10°C areas. Salmon feed on a variety of prey including crustaceans and small fish. The infusion of cold oceanic water into the Bay of Fundy and Gulf of Maine provides this temperature range and supports two of their principal prey species: sand lance and euphausiid. These temperature conditions, together with tag recovery information, indicate that the Bay of Fundy and northern Gulf of Maine constitute marine habitat for iBoF salmon (DFO 2013).

2.2 Species Distribution

The range of natural anadromous Atlantic salmon is essentially the North Atlantic Ocean and adjacent rivers. While Atlantic salmon were once present in Atlantic Canada in hundreds of rivers within the last half century (728 rivers by recent count), populations from many rivers in the southern reaches of their Canadian range are now extirpated (DFO 2010).

The iBoF salmon is genetically distinct from other nearby Atlantic salmon populations, and appears to exhibit unique migratory behaviour: they remain within the Bay of Fundy – Gulf of Maine area during

the marine phase of their life cycle. These populations spawn in those rivers of Nova Scotia (NS) and New Brunswick (NB) that drain into the Minas Basin and Chignecto Bay. The extent of marine occupancy and occurrence includes at least the Bay of Fundy and outlying oceanic waters. The locations of the iBoF salmon rivers are shown in the species' Recovery Strategy (DFO 2010).

At least 32 rivers in the inner Bay of Fundy supported self-sustaining salmon populations and another 10 rivers and streams are reported to have produced salmon. The Gaspereau, Stewiacke, Debert, Folly, Great Village, Portapique, Economy, Upper Salmon, Point Wolfe and Big Salmon rivers contain freshwater habitat that has been designated as critical habitat[2] for iBoF salmon in the species' recovery strategy. DFO recently reviewed and evaluated available information in support of the identification of important marine and estuarine habitat required for successful completion of all life-history stages of iBoF salmon (DFO 2013). The report proposes areas of important marine and estuarine habitat within the Bay of Fundy using the 'Bounding Box' approach, in which the functions and features of the habitat can be described, but their exact location cannot. Any boundaries described are considered as approximate, and, as new information is gathered, refinements to the areas used by salmon, including the important attributes of these areas, are expected.

Important marine and estuarine habitat of iBoF salmon has been identified in the tidal portions of 19 salmon rivers in the inner Bay of Fundy (the Gaspereau, Shubenacadie, Stewiacke, Salmon (Colchester), North (Colchester), Chiganois, Debert, Folly, Great Village, Portapique, Bass (Colchester), Economy, Harrington, Apple, Maccan, Petitcodiac, Upper Salmon, Point Wolfe, and Big Salmon) and the entire Bay of Fundy outward to the northern Gulf of Maine and the US/Canada boundary, southward to latitude 43°46'51 (DFO 2013). Overwintering habitats of all life-stages are as yet unknown, but are hypothesized to be off the Scotian Shelf or in the southern portion of the Gulf of Maine. Critical habitat for iBoF Salmon will be identified in the estuarine and marine environment in a forthcoming amended recovery strategy.

Minas Basin and Chignecto Bay were identified as important estuarine habitat for migration of post-smolts, adults, and kelts; feeding areas for post-smolts and kelts; and staging areas for adults. All but one (Big Salmon River) of the 19 iBoF salmon rivers identified as having important estuarine habitat flow into these two larger estuaries. Minas Basin and Chignecto Bay are inferred to be used as a migration corridor for post-smolts to the rest of the Bay of Fundy in May and June, and as feeding areas for post-smolts from June through September. Information on the migration of adults through the Minas Basin and Chignecto Bay into their natal rivers suggests that these estuaries are used by adults from May to October. Minas Basin is important for adult staging, acclimation to fresher waters, and possibly feeding for the period July through October. Kelts of rivers flowing into the Minas Basin and Chignecto Bay are thought to feed in and migrate through these waters in the winter/spring to access the rest of the Bay of Fundy for reconditioning.

2.3 Population Status and Trends

The historical population size of Atlantic salmon in iBoF rivers likely exceeded 40,000 adults earlier in the 20th century (COSEWIC 2006); abundance was reduced to as few as 250 adults by 1999. Estimates from 2008 suggest the total number of wild fish is likely to be less than 200 individuals (COSEWIC 2010).

[2] SARA defines 'critical habitat' as the habitat that is necessary for the survival or recovery of a listed wildlife species, and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

The status of iBoF Salmon populations has typically been assessed using data from the two most studied rivers, the Big Salmon and Stewiacke (DFO 2010). The size of the Stewiacke River population was estimated to be between 1,100 and 6,700 returning adults during the 1960s and early 1970s, with high variability from year to year. The estimated numbers of returns for the years 1997 to 2001 are less than 50 per year, and it is unlikely that more than four salmon returned to the Stewiacke River in 2001. Taken together, the annual abundance estimates indicate a decline of more than 99% between 1967 and 2000, with most of the decline occurring in the early and mid-1990s (about a 92% decrease from 1990 to 2000). The abundance of adult salmon monitored in other iBoF rivers shows similar declines.

The iBoF salmon once bred in many rivers tributary to the inner Bay of Fundy; however, spawning no longer occurs in most rivers. IBoF salmon's survival is currently dependent on supplementation from the Live Gene Bank (LGB) program, which is a spawning and rearing program designed to minimize the loss of genetic diversity and fitness in the remnant population. The Recovery Potential Assessment concluded that, without human intervention, iBoF salmon would be extinct within 10 years (DFO 2008). With the LGB program, populations are expected to persist at low population sizes in the longer term.

2.4 Threats

The factors that have caused the collapse of wild Atlantic salmon populations in the iBoF since the 1980s are not well understood. The decline in abundance of Atlantic salmon in all rivers around the iBoF at roughly the same time suggests common factors are acting on all iBoF salmon populations. Evidence suggests that the factor(s) limiting population recovery for iBoF salmon act during the marine life stage, resulting in low marine survival, rather than an inability to spawn and live successfully in freshwater rivers and streams (DFO 2010); however, the reasons for this are not yet clear.

Key threats were identified in the status report by COSEWIC (2006) and further reviewed in the March 2008 Recovery Potential Assessment for iBoF salmon (DFO 2008). Potential marine and freshwater threats are described in the 2010 recovery strategy and the 2010 COSEWIC status report (importance not implied by order):

Marine threats:

- Aquaculture: interactions with farmed and hatchery salmon (e.g., genetic inbreeding, competition with escapees for food, parasite and disease outbreaks, and modified predator interactions);
- Ecological community shifts (increased predator abundance; lack of or reduced forage species);
- Environmental shifts (temperature shifts depressing ocean productivity; altered migration routes leading to decreased survival);
- Fisheries (excessive illegal and/or incidental catches); and
- Depressed population phenomena (lack of recruits to form effective schools).

Freshwater threats:

- Changes in environmental conditions (e.g., climate changes leading to premature smolt emigration or decreasing freshwater productivity, and atmospheric changes increasing ultraviolet radiation and its impacts);
- Contaminants;
- Barriers to fish passage; and
- Depressed population phenomena (e.g., as a result of abnormal behaviour due to low abundance or because of inbreeding depression).

It is very improbable that declines in Atlantic salmon are due to any single cause, and factors contributing to a decline are likely to have acted in a cumulative manner (COSEWIC 2010).

2.4.1 Threats from Local Conditions

IBoF salmon populations are affected by local conditions, which may act on populations within individual rivers, and which could impact recovery if survival in the marine environment increases (DFO 2010). For example, some mortality can occur when developments do not provide adequate facilities for fish passage or when fish do not use these facilities. Similarly, water management for power generation, water extraction for irrigation, flood control, commercial and domestic water supplies, and effluent discharges are in place in many iBoF rivers and impact salmon habitat. Two projects in particular have raised concerns about threats to iBoF salmon.

Alton Natural Gas Storage Project

Project location: Shubenacadie River estuary, Nova Scotia

A natural gas storage company is currently building three underground caverns to store natural gas so it can be used for energy supply. To develop the storage caverns, a well is drilled into an existing salt formation and tidal water from the Shubenacadie River is cycled through the cavern to dissolve the salt in the deposit. The resulting brine will be pumped to a holding pond where it will be released back into the Shubenacadie River. The Shubenacadie River flows into the Bay of Fundy, and approximately 111 billion m^3 of ocean water flows enters the river with each tide.

Concerns have been expressed ~~about~~ that the release of the brine into the Shubenacadie River system could directly affect salmon migrating within areas of high salinity or impact their migration patterns as a result of a potential change in water chemistry. Other concerns include ~~the effects~~possible entrainment or impingement of salmon as a result of the withdrawal of water from the Shubenacadie River~~, and the discharge of sediments into the river~~. DFO has identified the Shubenacadie estuary as important habitat based on the predictable presence of iBoF salmon in that area (DFO 2013). It serves as an important migration corridor for iBoF Salmon to reach its critical habitat in the Stewiacke River.

Commented [CB1]: Innacu . rate. I think it is necessary to summarize the specific concerns to iBoF Salmon that have been raised.

Commented [LB2]: Could the Region please summarize in the text, what those specific concerns were?

Fundy Ocean Research Center for Energy

Project location: Minas Passage, inner Bay of Fundy, Nova Scotia

A tidal energy project in the Bay of Fundy is proposing to install experimental tidal current turbines in the Minas Passage to generate electricity. The purpose of the project is to construct and operate a facility to demonstrate and test in-stream tidal devices and assess their potential to generate electricity. The site will consist of underwater berths for turbines located in the Minas Passage, with power cables from the berths to an onshore facility. The turbines are each 16 metres in diameter and weigh 1,000 tonnes. Two turbines are to be installed initially, with the potential for more in the future.

Concerns have been expressed regarding the potential effects of the turbines on fish and fish habitat, including impacts on iBoF salmon. These potential effects include mortality associated with direct interactions with the turbine or changes in migration or behaviour as a result of noise generate by the devices. The Minas Passage is a migratory path for numerous fish species and the iBoF salmon are known to use this area.

Commented [CB3]: Again, I think it would be helpful to be more specific about the potential effects that are of concern (e.g., direct mortality in the turbine).

Commented [LB4]: Could the Region please provide those details (in the text)?

2.5 Existing Legislative Measures

Works, undertakings or activities (projects) likely to harm iBoF Salmon or destroy their habitat are subject to a number of federal and provincial regulatory mechanisms. Federal and provincial laws were examined to determine the extent to which they prevent the killing, harming, harassing, capture and taking of iBoF salmon individuals; damage or destruction of its residences; and destruction of its habitat.

2.5.1 Federal Authority

Species at Risk Act

IBoF salmon is listed on Schedule 1 of SARA, and activities that result, directly or indirectly, in killing, harming, harassing, capturing or taking an individual of a listed aquatic wildlife species are prohibited under section 32(1) of SARA. Proponents of works and developments in areas of iBoF salmon habitat must ensure compliance with the general SARA prohibitions on harm to individuals of iBoF salmon.

Section 32(2) also prohibits the possession, collection, buying, selling or trading of listed species at risk.

Section 33 of SARA prohibits the damage or destruction of the residence of a species at risk. Redds used for spawning by iBoF salmon are considered to be a 'residence'.

A forthcoming Critical Habitat Order will trigger a prohibition against destruction of any part of the species' critical habitat pursuant to subsection 58(1) of SARA. The prohibition against destruction of critical habitat in SARA 58(1) applies to all human activities within or outside of the critical habitat that result in a critical habitat function being made unavailable at a time when it is required by the species.

If destruction of critical habitat is likely to occur, the human activity is managed according to the DFO SARA guidelines for permitting. The permitting regime sets out the process for DFO to manage the section 58(1) prohibition against destruction of critical habitat and the general prohibitions of SARA (section 32 and SARA section 73 conditions in its management of human activities that have the potential to contravene the prohibition against the destruction of critical habitat. However, given that protection of critical habitat is a legal obligation, in cases where enough habitat information is available, DFO manages habitat identified as necessary for the survival and recovery of a listed species according to the section 73 conditions even prior to initiating legal protection or recovery planning. This is a precautionary approach used to ensure survival and recovery of the species.

The 2010 recovery strategy for the iBoF salmon included a description of critical habitat in the freshwater portion of their habitat, in the Gaspereau, Stewiacke, Debert, Folly, Great Village, Portapique, Economy, Upper Salmon, Point Wolfe and Big Salmon rivers. Efforts are currently underway to identify additional critical habitat in estuarine and marine areas. These areas are projected to be identified in an amended recovery strategy and protected via a Critical Habitat Order.

Canada National Parks Act

Protection to iBoF salmon habitat is also offered by the *Canada National Parks Act* and its regulations for the portion of iBoF salmon habitat that falls within the Fundy National Park of Canada (i.e., those portions of the Point Wolfe and Upper Salmon rivers within the park boundaries). A description of the critical habitat located within Fundy National Park of Canada was published in the *Canada Gazette* on November 5, 2010, pursuant to subsection 58(2) of SARA.

Fisheries Act

IBoF Salmon is part of a commercial, recreational or Aboriginal fishery. The *Fisheries Act* and its supporting regulations (the *Fishery (General) Regulations, the Maritime Provinces Fishery Regulations,* the *Atlantic Fishery Regulations, 1985*, and the *Aboriginal Communal Fishing Licences Regulation*) provide the tools to protect, conserve and manage fisheries.

The *Fisheries Act* has specific provisions that:

a. on the Minister's request, require the owner or person who has the charge, management or control of an obstruction or any other thing that is harmful to fish, to ensure the free passage of fish or prevent harm to fish from obstructions (section 20);
b. prohibit any undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery, unless authorized (section 35). Serious harm to fish is defined as the death of fish or any permanent alteration[3] to, or destruction[4] of, fish habitat;
c. prohibit the deposit of deleterious substances into waters frequented by fish unless regulated (section 36); and
d. on the Minister's to request, require procedures, schedules, analyses, samples, evaluations and other information to determine whether a work, undertaking or activity results or is likely to result in any serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery (section 37).

Under the regulations:

a. commercial, recreational and Aboriginal Atlantic salmon fisheries have been closed since 1990 on all iBoF rivers except for the Gaspereau River. The Gaspereau River remained open for Atlantic salmon recreational and food fisheries until 1994, was closed in 1995 and re-opened with limited food fishery agreements and a shorter catch-and-release angling season in 1996 and 1997;
b. the retention of incidentally caught salmon is strictly prohibited; and,
c. it is illegal to release live fish into fish habitat without a federal licence. This is to minimize disease, genetic, ecological or other adverse effects to wild fish and their habitat(s).

All commercial fisheries for Atlantic salmon in the Bay of Fundy were closed after the 1984 season. Recreational fisheries for Atlantic salmon in iBoF rivers were reduced in the years following the closure of the commercial fishery and subsequently closed since 1990 except for the Gaspereau River. The Gaspereau River remained open for recreational and food fisheries until 1994, was closed in 1995 and re-opened with limited food fishery agreements and a shorter catch-and-release only angling season in 1996 and 1997.

2.5.2 Provincial authority

The provinces have exclusive legislative authority over matters dealing with property and civil rights and the management of public lands, including those pertaining to public fisheries, water and substrates. In

[3] A permanent alteration to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes.

[4] The destruction of fish habitat of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes.

both NS and NB the control of water rights are also areas of provincial responsibility. With respect to ownership of the riverbed, in NS and NB it is asserted to be owned by the crown (the province); however in NB, private landowners claim to have been granted riparian rights. The provinces regulate the terms and conditions of access to the recreational fisheries in freshwater. Similarly, the granting of special privileges to limit access to certain waters falls under provincial jurisdiction.

NB and NS also have legislation regarding environmental protection, land use, riparian rights associated with water quantity and water quality, forest management, mining, aquaculture development, agriculture, and highway and infrastructure development.

The NB Department of Natural Resources, the NS Department of Fisheries and Aquaculture and the NS Department of Natural Resources administer their respective provincial natural resource management legislation and also support the federal *Fisheries Act*. Both provinces have environmental agencies (NS Department of Environment, NB Department of Environment) for delivery of their environmental legislation. Examples of provincial legislation that directly and indirectly afford protection to iBoF salmon in NB include the provincial *Species at Risk Act*, *Aquaculture Act*, *Clean Environment Act*, *Clean Water Act*, *Ecological Reserves Act*, *Crown Land and Forests Act*, *Pesticide Control Act* and the *Fish and Wildlife Act*; and, in Nova Scotia, the *Endangered Species Act*, *Fisheries and Coastal Resources Act*, *Wildlife Act*, *Environment Act* and *Angling Act*.

New Brunswick

The provincial *Species at Risk Act* lists the iBoF salmon as an endangered species; however, the legislation does not provide an automatic prohibition against habitat destruction.

The *Clean Water Act* was established in 1989 and houses many of the most important pieces of provincial legislation related to protecting the quality and quantity of the waters in rivers, streams and lakes that underpin the diversity of aquatic habitats and species, recreational opportunities and drinking water supplies. Key regulations for the protection of surface water include the *Watershed Protected Areas Designation Order* (2001) *Water Classification Regulation* (2002), and the *Watercourse and Wetland Alteration Regulation* (1990). Ground water drinking supplies are regulated by the *Potable Water Regulation* (1993) the *Water Well Regulation* (2002). The *Water Quality Regulation* under the *Clean Environment Act* prohibits, without permit, the pollution of any waters in the province.

Fish and Wildlife Act: The Department of Natural Resources and Energy has a proprietary responsibility to protect fish and wildlife by virtue of the legislation contained in section 3(1) of the *Fish and Wildlife Act*.

Nova Scotia

The *Fisheries and Coastal Resources Act* is the primary piece of legislation for the NS Department of Fisheries and Aquaculture. This Act provides authority for most of the Department's functions and activities including the ability of the Minister of Fisheries and Aquaculture to issue, terminate, and impose terms and conditions on aquaculture sites (licences and leases).

The *Wildlife Act* provides for the regulation of hunting and fishing and the possession and sale of wildlife.

The *Environment Act* supports and promotes the protection, enhancement and prudent use of the environment. It prohibits the release of a substance that causes or may cause an adverse effect, unless

authorized by an approval or the regulations. The *Activities Designation Regulations* require approvals for watercourse alterations. The *Environmental Assessment Regulations* require any undertaking that may disrupt two or more hectares of a wetland to be registered with NS Environment.

The *Water Resources Protection Act* regulates the removal of water from any of the province's drainage basins and prohibits the bulk removal of water.

The *Forests Act* helps to maintain or enhance wildlife and wildlife habitats, water quality, recreational opportunities and associated resources of the forest. It ensures that wildlife, wildlife habitats and the long term diversity and stability of the forest ecosystems, water supply watersheds and other significant resources are managed appropriately. The *Wildlife Habitat and Watercourses Protection Regulations* are specific to forest harvesting and specify that forestry operators must ensure the establishment of a special management zone of at least 20 m in width along the boundaries of watercourses. The regulations are applicable on all lands regardless of ownership.

2.6 Conservation Measures

Existing conservation measures were examined to determine the extent to which they mitigate threats to the survival and recovery of the iBoF salmon. Should marine survival return to healthier, pre-mid 1980s levels (e.g., the Big Salmon River population was in the range of 1,000 to 4,000 salmon), then impacts to freshwater habitat that affect the productive capacity of iBoF salmon (e.g., rate and level of smolt production) will become the dominant factors in their recovery (DFO 2008, 2010). For this reason, recovery actions need to address both regional marine and freshwater threats to iBoF salmon populations.

The proposed action plan (DFO 2016) for iBoF salmon outlines 35 recovery measures that address all the recovery objectives of the 2010 recovery strategy, including measures to identify and remedy threats in both the freshwater and marine environments.

The Live Gene Bank (LGB) Program

Live Gene Banks (LGBs) have been established for the iBoF salmon for over 15 years (initiated in 1998) in NB and NS. The purpose of this program is to maintain the potential for iBoF salmon recovery by preserving the genetic base thought to be representative of the populations. The LGB program has been used to maintain the persistence of iBoF salmon to date, and a plan to continue for a further five years is currently under development (DFO 2016). The program will, however, continue to be periodically reviewed and re-evaluated, with adjustments made as appropriate to accommodate new information and changing conditions.

The LGB program is currently focused on four rivers: the Stewiacke and Gaspereau in NS, and the Big Salmon and Point Wolfe in NB. LGB fish have also, however, been released into the Upper Salmon, Weldon Creek, Demoiselle, Petitcodiac, Black, Economy, Great Village, Debert, Folly, Salmon (Colchester), Cornwallis, and Portapique rivers.

Efforts to identify and remedy threats in the marine environment

Efforts to date have involved a range of activities, including literature reviews and field studies to determine the marine habitat quality, quantity and use by iBoF salmon populations, and surface trawling surveys and acoustic tagging experiments of post-smolts to determine their distribution during fall and winter months at sea. Other studies are focused on developing electronic tags and tag release

mechanisms to extend the range of data that can be collected from these types of projects, and analysis of historical scale patterns as a means of detecting changes in environmental conditions or migration patterns.

The advice summarized in DFO's 2013 report is being used to inform the identification of marine and estuarine critical habitat in an amended Recovery Strategy. The 2013 report provides information on the important biophysical functions, features, and attributes of each relevant iBoF salmon life-history stage. In the marine and estuarine habitat of iBoF salmon:

- Important functions are migration, feeding, and staging;
- Important features are migration corridors, estuarine holding pools, surface waters, upwellings, and food availability;
- Important attributes of these features include temperature, salinity, water flow, depth/volume, forage species, (e.g. sandlance, herring, euphausiids, amphipods), and predator abundance.

Efforts to identify and remedy threats in the freshwater environment

Several studies have been undertaken to date to provide information on iBoF salmon freshwater habitat use, quality, and quantity (DFO 2010). Stream habitat slopes have been classified and mapped in a Geographic Information System (GIS) format for 23 iBoF rivers; a study on the habitat use by juvenile salmon has recently been completed; and tracking experiments have clarified habitat needs for juveniles and adult spawners. Other work documenting other types of habitat and use by iBoF salmon is underway and includes the development of a habitat survey database for juvenile Atlantic salmon in the Memramcook River and adjacent tributaries, culvert surveys and stream experiments to determine the effects of nutrient enrichment.

Ongoing freshwater habitat restoration activities will also contribute to achieving the objectives and goals of this recovery strategy and efforts are regularly undertaken by government agencies and interested stakeholders.

Additional projects underway include a trial of the upstream migration of adult salmon to the White Rock fishway on the Gaspereau River under controlled flow conditions, an inventory of culvert installations within the Maritimes region of DFO and subsequent development of guidelines for their installation, and the assessment of the 243 aboiteaus within NS iBoF watersheds.

3.0 Assessment

3.1 Population and Distribution Objectives

The overarching recovery goal for iBoF salmon is "*to re-establish wild, self-sustaining populations as required to conserve the genetic characteristics of the remaining iBoF salmon*" (DFO 2010). The population and distribution objectives established in the species' recovery strategy set out the basis for achieving a recovered state for the species. Creating and maintaining the necessary conditions to conserve the genetic characteristics of iBoF Salmon and re-establish wild self-sustaining populations will be accomplished by implementing these objectives (DFO 2010).

The population and distribution objective in the short term is to progress towards re-establishing self-sustaining populations to their conservation levels in the following 10 river systems that contribute to the LGB program: Gaspereau, Stewiacke, Debert, Folly, Great Village, Portapique, Economy, Upper

Salmon, Point Wolfe and Big Salmon. These are the rivers that have also been identified as critical habitat for iBoF salmon in the species' recovery strategy.

The longer-term target for recovery, should marine survival increase, is to re-establish self-sustaining populations of iBoF Atlantic salmon to a conservation level of 9,900 spawning adults distributed throughout the following 19 river systems: Gaspereau, Shubenacadie, Stewiacke, Salmon (Colchester), North (Colchester), Chiganois, Debert, Folly, Great Village, Portapique, Bass (Colchester), Economy, Harrington, Apple, Maccan, Petitcodiac, Upper Salmon, Point Wolfe and Big Salmon. This target recognises that once marine survival rates for iBoF salmon improve, recovery efforts in a greater number of rivers will become increasingly valuable for long-term population self-sustainability. There are no timelines associated with this target.

3.2 DFO Project Assessments

DFO directs all proponents of projects affecting iBoF salmon to apply for an authorization under SARA and, if applicable, the *Fisheries Act*. Under section 73 of SARA, the Minister of Fisheries and Oceans may only authorize a person to engage in an activity affecting a listed aquatic species, any part of its critical habitat, or the residences of its individuals under certain conditions. Included among these conditions (sub-section 73(3)) is that the competent minister is of the opinion that:

> a) all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted;
> b) all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals; and
> c) the activity will not jeopardize the survival or recovery of the species.

DFO carries out regulatory reviews under the *Fisheries Act* of all projects that have the potential to result in serious harm to fish. The review of any proposed project also takes into consideration whether it complies with SARA, a process that is already well established in both NS and NB.

DFO has arrangements with provincial governments, who conduct an initial review of projects in freshwater, marine and coastal environments under their respective jurisdictions, to determine whether they require advice or DFO review under the fisheries protection provisions of the *Fisheries Act*.

In addition, DFO participates in the NS and NB Watercourse Alteration Regulatory Programs. For example, in NS, watercourse alteration permits are issued under a joint review process. A Canada-Nova Scotia Memorandum of Understanding on Fish Habitat Management facilitates a collaborative approach to the conservation, protection and enhancement of fish habitat. Neither of the above-mentioned specific projects occurs within the areas currently identified as iBoF salmon critical habitat; however, they are within areas identified as important marine and estuarine habitat for iBoF salmon (DFO 2013).

DFO's reviews of these projects took into account the potential impacts on SARA-listed species, including iBoF salmon.

Alton Natural Gas Storage Project

Nova Scotia Environment conducted an environmental assessment of the project and issued an environmental assessment approval in 2007. DFO, along with other federal and provincial departments, provided expert advice on the potential impacts of the project and adequacy of the proposed mitigation. The Department provided expertise in fish life histories, including Atlantic salmon, as well as technical

advice on mitigation and monitoring to ensure there are no impacts to fish and fish habitat. Mitigation and monitoring in place to reduce potential impacts to iBoF Salmon include: ensure salinity is no greater than 7 parts per thousand (ppt) (to a maxiumum of 28ppt) at 5 metres from the diffuser during smolt migrations; monitor the Salmon use of mixing channel in the first year of operation; monitor the intake structure for entrainment of any fish species; and monitor salinity levels at the enteraences to the mixing channel and within the river to ensure level remain within background limits.

DFO determined that the project is unlikely to cause 'serious harm to fish' as there would be no destruction or permanent alteration of fish habitat or the death of fish (from physical impacts such as entrainment), ~~or impacts to SARA species,~~ therefore ~~neither a~~n Authorization under section 35(2)(b) of the *Fisheries Act* ~~nor a SARA permit is~~was required. The project was also assessed for potential impacts to iBoF Salmon, the only SARA-listed species near the project site. The pathways of effects included exposure to brine (higher than normal salinity) and entrainment at the intake strutures. These potential effects could impact only migrating adults and smolts as there is no spawning or rearing habitat near the project site.

The potential to exposure to higher than normality salinity was considered moderate as it is possible for a Salmon (adult or smolt) to move through the mixing channel. However, given that fish are known to be able to detect changes in salinity, Salmon may avoid the mixing channel. If, however, a Salmon were to move through the mixing channel the exposure to high salinities (5 metres from the diffuser) would be extreamly brief (estimated at 5 to 7 seconds) as brining only occurs during the tide. Toxicity testing of juvenile Striped Bass at only 3.5 millimetres in length did not experience mortality until after several minutes of exposure to brine levels as high as 100ppt. Therefore, no morality of Salmon smolts at 71 to 76 centimetres is expected given the length of possible exposure.

Concerns were raised in the introduction of bine could impact the homing ability of Salmon during their migration. However, the brine will represent less than 0.009% of the overall river flow and although possible for Salmon to detect these low level changes, it is unlikely to impact migration as salinity levels in the river fluctuate from 0ppt to 28ppt.

The project requires 10,000 cubic metres per day or 0.12 cubic metres (120 litres) per second. The intake surface area of the gabion wall ranges from 244 square metres to 52 square metres depending on the tidal level and river flows. This large surface will allow enough water to gravity feed through the wall to provide the needed volumes for the intake pipe. The maximum velocity predicted at the site is 0.0056 metre per second (m/sec) and the escape velocity for fish such as a Salmon smolt is 0.11 m/sec. Therefore the intake velocities are well below the escape velocity of a Salmon smolt, therefore it is unlike that any Salmon would be entrained in the intake structure. ~~A detailed review of the Alton Gas Project was completed and detailed advice on mitigation and monitoring was provided by DFO to the regulator, Nova Scotia Environment.~~

~~A detailed review of the Alton Gas Project was completed and detailed advice on mitigation and monitoring was provided by DFO to the regulator, Nova Scotia Environment.~~A Nova Scotia Environment approval to operate the brine pond was issued on January 21, 2016, and the conditions of approval include river site monitoring and mitigation plans reviewed by DFO. Atlantic salmon smolt acoustic tagging will be conducted to determine whether they use the constructed mixing channel in the spring of the first year of operation. Salinity levels will be monitored to ensure that they are within acceptable limits. DFO will continue to provide expert advice on monitoring results to ensure the measures put in place by the proponent are effective in mitigating all impacts to fish species, including iBoF salmon, found near the project area.

Commented [LB5]: Can the Region please add a sentence here to explain what specific mitigation and monitoring activities will be put in place to ensure no impacts on iBoF Salmon.

Commented [LB6]: Can the Region provide a summary of the effects assessments used to make both the EA decision and serious harm to fish decision.

Summary should include:
- Potential environmental effects to iBoF Salmon from the project that were considered and assessed
- the number and life stages of iBoF Salmon that are likely to be affected
- the extent and type of iBoF Salmon habitat that is likely to be affected
- the probability, magnitude, geographic extent and duration of the likely effects on iBoF Salmon and their habitat
- A rationale to support the conclusions of each effect that was assessed, and to support the overall conclusion that this project will not cause serious harm to fish or jeopardize survival or recovery of iBoF Salmon

Commented [LB7]: Can the Region provide a summary of the effects assessments used to make both the EA decision and serious harm to fish decision.

Summary should include:
- Potential environmental effects to iBoF Salmon from the project that were considered and assessed
- the number and life stages of iBoF Salmon that are likely to be affected
- the extent and type of iBoF Salmon habitat that is likely to be affected
- the probability, magnitude, geographic extent and duration of the likely effects on iBoF Salmon and their habitat
- A rationale to support the conclusions of each effect that was assessed, and to support the overall conclusion that this project will not cause serious harm to fish or jeopardize survival or recovery of iBoF Salmon

Commented [LB8]: Can you provide a few details on these measures?

Commented [MGM9]: See mitigation and monitoring details added above.

Fundy Ocean Research Center for Energy

Since 2005, DFO has been engaged in the review of several environmental assessments to predict potential environmental effects associated with tidal power development in the Bay of Fundy and has also been involved in a number of studies to better understand potential effects on the marine ecosystem. Most recently, DFO has been involved in the review of environmental effects monitoring programs (EEMPs) associated with the proposed installation of tidal turbines in the Minas Passage. Departmental scientists have also reviewed baseline studies and proposed monitoring programs provided by FORCE and Cape Sharp Tidal. The department provided recent advice on the EEMPs proposed by Fundy Ocean Research Centre for Energy (FORCE) and Cape Sharp Tidal Venture, the proponents of these projects, and recommended the development of further studies and an expanded monitoring program.

Commented [LB10]: Can you highlight the potential effects that are relevant to iBoF Salmon?

Commented [MGM11]: See text added below.

In 2015, DFO reviewed the potential for 'serious harm to fish' from the installation and intended 15-year operation of two turbines. Impacts to fish and fish habitat were considered from both the installation and operation of the turbines. As a result of installation (including construction, maintenance, decommissioning) of the turbines, impacts to fish and fish habitat could occur from three stressors: collisions with vessels; noise/disturbance from vessels and machinery; and physical alteration of habitat. As a result of operation of the turbines, impacts to fish and fish habitat could occur from five stressors: collisions, including strikes with device components, entrapment in cables and other structures; noise/vibrations emitted from devices; electromagnetic fields emitted from power output cables; presence of artificial structures; and reduction of current energy.

The review concluded that no residual serious harm to fish is expected to occur from the installation or operation of the turbines[5]. Relative to the amount of similar habitat available in the local area, the geographic scale of impacts is very low. The vessels and equipment used to install, construct, maintain and decommission the turbines, as well as the impacts caused by them will be very small relative to the area in which they will be operating. The installation and operation of the turbines is also not expected to impact the availability or condition of nearby fish habitat. In the immediate vicinity, habitat type is similar/identical to that of the area where the turbines would be installed. It was also concluded that given the relatively slow speed of the turbines (7 to 10 revolutions per minute) and monitoring done of similar devices in other countries which showed no impacts to fish, that there were be no direct impacts from the devices on iBoF Salmon. It is also predicted that any other possible effects of the devices (entrapment in cables; noise/vibrations; electromagnetic fields; presence of artificial structures; and reduction of current energy) would be limited in scale with the deployment of these two turbines, that they would not have any impact on Salmon migration through the area. Therefore the placement of these two devices in the Minas Passage is not expected jeopardize the~~o~~ survival or recovery of iBoF Salmon

Commented [LB12]: Did this review also conclude that the project would not jeopardize survival or recovery of iBoF Salmon?

3.3 Conclusion

An Emergency Order may identify habitat that is necessary for the survival or recovery of the species. The 2010 recovery strategy for the iBoF salmon included a description of critical habitat in the freshwater portion of their habitat. A Critical Habitat Order is already in development for these areas. Efforts are currently underway to identify additional critical habitat in estuarine and marine areas, which will be identified in an amended recovery strategy and which will also be protected via a Critical Habitat

[5] After efforts have been made to avoid and mitigate impacts, any residual serious harm to fish would have to be addressed by offsetting.

Order. These processes are expected to take place within a timeframe that will avoid irreversible harm to the population.

An Emergency Order may include provisions requiring the doing of things that protect the species and that habitat, or provisions prohibiting activities that may adversely affect the species and its habitat. Threats to the iBoF salmon's survival or recovery from the two specific projects outlined above are already being addressed through the implementation of ongoing conservation and recovery measures and the existing regulatory framework. DFO carried out regulatory reviews under the *Fisheries Act* of the above-mentioned projects and took into consideration whether the project activities would comply with SARA. In both cases, it was concluded that the potential for impacts to iBoF salmon and salmon habitat are not significant and should not impede the population and distribution objectives for the recovery of iBoF salmon from being attained. DFO is currently not aware of any planned or ongoing activities that would need to be mitigated beyond the requirements of existing legislative or regulatory regimes.

The survival of the iBoF salmon is currently maintained through continued monitoring and the LGB program.

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Stewart, Julie

From: Crocker, Joe
Sent: Monday, November 7, 2016 7:41 AM
To: Stewart, Julie
Subject: FW: IBoF Imminent Threat Assessment
Attachments: Imminent Threat Assessment for the iBoF Salmon_rev Oct 31_2016.docx

I know u have been very busy but when u have chance, pls let us know if ur ok with this.

From: Burr, Linda
Sent: October-31-16 10:10 AM
To: Stewart, Julie
Cc: Crocker, Joe
Subject: IBoF Imminent Threat Assessment

Hi Julie,

We obtained some additional details on recent project assessments from the Region, and the IBoF salmon imminent threat assessment is now complete (attached).

Linda Burr
613-990-6552

Imminent Threat Assessment for the Atlantic Salmon, Inner Bay of Fundy populations

1.0 Issue

In May 2001, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the Atlantic salmon, inner Bay of Fundy populations (hereafter iBoF salmon), as Endangered. The Government of Canada designated the iBoF salmon as Endangered under Schedule 1 of the *Species at Risk Act* (SARA) when the Act came into force in June 2003. Following an updated status report and re-assessment by COSEWIC in April 2006 and a re-examination in November 2010, the status of the iBoF salmon was confirmed as Endangered[1].

Section 80 of SARA states that the competent minister must make a recommendation to the Governor in Council to make an Emergency Order to provide for the protection of a listed wildlife species if the competent minister is of the opinion that the species faces imminent threats to its survival or recovery. The Minister of Fisheries and Oceans (MFO) is the competent minister under SARA for the iBoF salmon, except for the portions of critical habitat within Fundy National Park of Canada, which is administered by the Parks Canada Agency.

In the case of an aquatic species, an Emergency Order may

- identify habitat that is necessary for the survival or recovery of the species in the area to which the Emergency Order relates; and/or
- include provisions requiring the doing of things that protect the species and that habitat, or provisions prohibiting activities that may adversely affect the species and that habitat.

The section 80 provision of SARA is intended for exceptional circumstances: when irreversible harm to a wildlife species is likely to occur without immediate intervention owing to a sudden or unforeseen activity; where existing protection measures do not exist; and when the normal processes would not be completed within a timeframe to address the irreversible harm.

This document assesses the current threats to the iBoF salmon, using the best available information, with the aim of informing an opinion as to whether this wildlife species faces imminent threats to its survival or recovery in Canada, and whether an Emergency Order would be required. The assessment considers the population and distribution objectives set out in the federal recovery strategy for the species. It takes into account information on the biology and ecology of the species, threats to its survival and recovery, and its current population and habitat status and trends. An analysis of existing legislative measures that protect the species against threats from human activity is also provided. Finally, recent DFO reviews of two projects that occur in important iBoF salmon habitat are summarized, along with their conclusions.

Socio-economic impacts were not considered in the assessment, as they are not relevant to determining whether or not a wildlife species is facing imminent threats to its survival or recovery. Socio-economic considerations would inform a Governor in Council decision, further to a recommendation by the competent minister.

[1] An "endangered species" is defined under SARA as a wildlife species facing imminent extirpation or extinction.

2.0 Background

2.1 Species Biology

The life cycle of the Atlantic salmon contains many stages. Adult iBoF salmon spawn in October and November. After spawning, surviving adults ('kelts') may return to sea immediately where they continue to grow until the next spawning season or remain in the river over winter and return to sea in the spring. The eggs develop in the redd during the winter and hatch in the spring (March or April). The young remain buried in the gravel as 'alevins', absorbing the yolk sac until May or June, at which point they emerge as 'fry', and grow as 'parr' feeding on invertebrate drift. Parr become 'smolt' after two or three years in fresh water, then enter the ocean where they grow rapidly to maturity. Adults spend part of their life feeding and growing at sea (which for iBoF salmon is mainly the Bay of Fundy and northern Gulf of Maine), and then return to reproduce in the freshwater stream where they hatched. The adult stage is usually one year (a single reproductive event), although some have been known to live for up to three years. IBoF salmon are unique in that the majority of fish mature after only one winter at sea.

At maturity, they home to their river of origin. Straying rates are low, typically less than 5%. Atlantic salmon that are ready to spawn begin moving up rivers from spring through fall. Although the timing of river entry varies among populations as an adaptation to local conditions and a response to water levels, these spawning runs are surprisingly consistent, occurring at the same time each year for each river (DFO 2010).

Requirements in Freshwater

Atlantic salmon streams are generally clean, cool, well oxygenated, characterized by moderately low to moderately steep gradients, and have bottom substrates composed of assorted gravel, cobble and boulder. Salmon prefer stable stream channels that develop natural riffles, rapids, pools and flats, which are utilized during different life stages. Except in areas affected by localized pollution sources, water quality in iBoF rivers is good to excellent for Atlantic salmon production.

Requirements in Marine Waters

Marine habitat requirements for iBoF salmon are less well known than those for freshwater. The only available indicator of marine habitat quality for Atlantic salmon is temperature. The marine temperature preference for Atlantic salmon ranges between 1-13°C, with high preference for 4-10°C areas. Salmon feed on a variety of prey including crustaceans and small fish. The infusion of cold oceanic water into the Bay of Fundy and Gulf of Maine provides this temperature range and supports two of their principal prey species: sand lance and euphausiid. These temperature conditions, together with tag recovery information, indicate that the Bay of Fundy and northern Gulf of Maine constitute marine habitat for iBoF salmon (DFO 2013).

2.2 Species Distribution

The range of natural anadromous Atlantic salmon is essentially the North Atlantic Ocean and adjacent rivers. While Atlantic salmon were once present in Atlantic Canada in hundreds of rivers within the last half century (728 rivers by recent count), populations from many rivers in the southern reaches of their Canadian range are now extirpated (DFO 2010).

The iBoF salmon is genetically distinct from other nearby Atlantic salmon populations, and appears to exhibit unique migratory behaviour: they remain within the Bay of Fundy – Gulf of Maine area during

the marine phase of their life cycle. These populations spawn in those rivers of Nova Scotia (NS) and New Brunswick (NB) that drain into the Minas Basin and Chignecto Bay. The extent of marine occupancy and occurrence includes at least the Bay of Fundy and outlying oceanic waters. The locations of the iBoF salmon rivers are shown in the species' Recovery Strategy (DFO 2010).

At least 32 rivers in the inner Bay of Fundy supported self-sustaining salmon populations and another 10 rivers and streams are reported to have produced salmon. The Gaspereau, Stewiacke, Debert, Folly, Great Village, Portapique, Economy, Upper Salmon, Point Wolfe and Big Salmon rivers contain freshwater habitat that has been designated as critical habitat[2] for iBoF salmon in the species' recovery strategy. DFO recently reviewed and evaluated available information in support of the identification of important marine and estuarine habitat required for successful completion of all life-history stages of iBoF salmon (DFO 2013). The report proposes areas of important marine and estuarine habitat within the Bay of Fundy using the 'Bounding Box' approach, in which the functions and features of the habitat can be described, but their exact location cannot. Any boundaries described are considered as approximate, and, as new information is gathered, refinements to the areas used by salmon, including the important attributes of these areas, are expected.

Important marine and estuarine habitat of iBoF salmon has been identified in the tidal portions of 19 salmon rivers in the inner Bay of Fundy (the Gaspereau, Shubenacadie, Stewiacke, Salmon (Colchester), North (Colchester), Chiganois, Debert, Folly, Great Village, Portapique, Bass (Colchester), Economy, Harrington, Apple, Maccan, Petitcodiac, Upper Salmon, Point Wolfe, and Big Salmon) and the entire Bay of Fundy outward to the northern Gulf of Maine and the US/Canada boundary, southward to latitude 43°46'51 (DFO 2013). Overwintering habitats of all life-stages are as yet unknown, but are hypothesized to be off the Scotian Shelf or in the southern portion of the Gulf of Maine. Critical habitat for iBoF Salmon will be identified in the estuarine and marine environment in a forthcoming amended recovery strategy.

Minas Basin and Chignecto Bay were identified as important estuarine habitat for migration of post-smolts, adults, and kelts; feeding areas for post-smolts and kelts; and staging areas for adults. All but one (Big Salmon River) of the 19 iBoF salmon rivers identified as having important estuarine habitat flow into these two larger estuaries. Minas Basin and Chignecto Bay are inferred to be used as a migration corridor for post-smolts to the rest of the Bay of Fundy in May and June, and as feeding areas for post-smolts from June through September. Information on the migration of adults through the Minas Basin and Chignecto Bay into their natal rivers suggests that these estuaries are used by adults from May to October. Minas Basin is important for adult staging, acclimation to fresher waters, and possibly feeding for the period July through October. Kelts of rivers flowing into the Minas Basin and Chignecto Bay are thought to feed in and migrate through these waters in the winter/spring to access the rest of the Bay of Fundy for reconditioning.

2.3 Population Status and Trends

The historical population size of Atlantic salmon in iBoF rivers likely exceeded 40,000 adults earlier in the 20th century (COSEWIC 2006); abundance was reduced to as few as 250 adults by 1999. Estimates from 2008 suggest the total number of wild fish is likely to be less than 200 individuals (COSEWIC 2010).

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[2] SARA defines 'critical habitat' as the habitat that is necessary for the survival or recovery of a listed wildlife species, and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

The status of iBoF Salmon populations has typically been assessed using data from the two most studied rivers, the Big Salmon and Stewiacke (DFO 2010). The size of the Stewiacke River population was estimated to be between 1,100 and 6,700 returning adults during the 1960s and early 1970s, with high variability from year to year. The estimated numbers of returns for the years 1997 to 2001 are less than 50 per year, and it is unlikely that more than four salmon returned to the Stewiacke River in 2001. Taken together, the annual abundance estimates indicate a decline of more than 99% between 1967 and 2000, with most of the decline occurring in the early and mid-1990s (about a 92% decrease from 1990 to 2000). The abundance of adult salmon monitored in other iBoF rivers shows similar declines.

The iBoF salmon once bred in many rivers tributary to the inner Bay of Fundy; however, spawning no longer occurs in most rivers. IBoF salmon's survival is currently dependent on supplementation from the Live Gene Bank (LGB) program, which is a spawning and rearing program designed to minimize the loss of genetic diversity and fitness in the remnant population. The Recovery Potential Assessment concluded that, without human intervention, iBoF salmon would be extinct within 10 years (DFO 2008). With the LGB program, populations are expected to persist at low population sizes in the longer term.

2.4 Threats

The factors that have caused the collapse of wild Atlantic salmon populations in the iBoF since the 1980s are not well understood. The decline in abundance of Atlantic salmon in all rivers around the iBoF at roughly the same time suggests common factors are acting on all iBoF salmon populations. Evidence suggests that the factor(s) limiting population recovery for iBoF salmon act during the marine life stage, resulting in low marine survival, rather than an inability to spawn and live successfully in freshwater rivers and streams (DFO 2010); however, the reasons for this are not yet clear.

Key threats were identified in the status report by COSEWIC (2006) and further reviewed in the March 2008 Recovery Potential Assessment for iBoF salmon (DFO 2008). Potential marine and freshwater threats are described in the 2010 recovery strategy and the 2010 COSEWIC status report (importance not implied by order):

Marine threats:

- Aquaculture: interactions with farmed and hatchery salmon (e.g., genetic inbreeding, competition with escapees for food, parasite and disease outbreaks, and modified predator interactions);
- Ecological community shifts (increased predator abundance; lack of or reduced forage species);
- Environmental shifts (temperature shifts depressing ocean productivity; altered migration routes leading to decreased survival);
- Fisheries (excessive illegal and/or incidental catches); and
- Depressed population phenomena (lack of recruits to form effective schools).

Freshwater threats:

- Changes in environmental conditions (e.g., climate changes leading to premature smolt emigration or decreasing freshwater productivity, and atmospheric changes increasing ultraviolet radiation and its impacts);
- Contaminants;
- Barriers to fish passage; and
- Depressed population phenomena (e.g., as a result of abnormal behaviour due to low abundance or because of inbreeding depression).

It is very improbable that declines in Atlantic salmon are due to any single cause, and factors contributing to a decline are likely to have acted in a cumulative manner (COSEWIC 2010).

2.4.1 Threats from Local Conditions

IBoF salmon populations are affected by local conditions that may act on populations within individual rivers, and which could impact recovery if survival in the marine environment increases (DFO 2010). For example, some mortality can occur when developments do not provide adequate facilities for fish passage or when fish do not use these facilities. Similarly, water management for power generation, water extraction for irrigation, flood control, commercial and domestic water supplies, and effluent discharges are in place in many iBoF rivers and impact salmon habitat. Two projects in particular have raised concerns about threats to iBoF salmon.

Alton Natural Gas Storage Project

Project location: Shubenacadie River estuary, Nova Scotia

A natural gas storage company is currently building three underground caverns to store natural gas so it can be used for energy supply. To develop the storage caverns, a well is drilled into an existing salt formation and tidal water from the Shubenacadie River is cycled through the cavern to dissolve the salt in the deposit. The resulting brine will be pumped to a holding pond where it will be released back into the Shubenacadie River. The Shubenacadie River flows into the Bay of Fundy, and approximately 111 billion cubic metres of ocean water flows enters the river with each tide.

Concerns have been expressed that the release of the brine into the Shubenacadie River system could directly affect salmon migrating within areas of high salinity or impact their migration patterns as a result of a potential change in water chemistry. Other concerns include possible entrainment or impingement of salmon as a result of the withdrawal of water from the Shubenacadie River. DFO has identified the Shubenacadie estuary as important habitat based on the predictable presence of iBoF salmon in that area (DFO 2013). It serves as an important migration corridor for iBoF Salmon to reach its critical habitat in the Stewiacke River.

Fundy Ocean Research Center for Energy

Project location: Minas Passage, inner Bay of Fundy, Nova Scotia

A tidal energy project in the Bay of Fundy is proposing to install experimental tidal current turbines in the Minas Passage to generate electricity. The purpose of the project is to construct and operate a facility to demonstrate and test in-stream tidal devices and assess their potential to generate electricity. The site will consist of underwater berths for turbines located in the Minas Passage, with power cables from the berths to an onshore facility. The turbines are each 16 metres in diameter and weigh 1,000 tonnes. Two turbines are to be installed initially, with the potential for more in the future.

Concerns have been expressed regarding the potential effects of the turbines on fish and fish habitat, including impacts on iBoF salmon. These potential effects include mortality associated with direct interactions with the turbine or changes in migration or behaviour as a result of noise generated by the devices. The Minas Passage is a migratory path for numerous fish species and the iBoF salmon are known to use this area.

2.5 Existing Legislative Measures

Works, undertakings or activities (projects) likely to harm iBoF Salmon or destroy their habitat are subject to a number of federal and provincial regulatory mechanisms. Federal and provincial laws were examined to determine the extent to which they prevent the killing, harming, harassing, capture and taking of iBoF salmon individuals; damage or destruction of its residences; and destruction of its habitat.

2.5.1 Federal Authority

Species at Risk Act

The iBoF salmon is listed on Schedule 1 of SARA, and activities that result, directly or indirectly, in killing, harming, harassing, capturing or taking an individual of a listed aquatic wildlife species are prohibited under section 32(1) of SARA. Proponents of works and developments in areas of iBoF salmon habitat must ensure compliance with the general SARA prohibitions on harm to individuals of iBoF salmon.

Section 32(2) also prohibits the possession, collection, buying, selling or trading of listed species at risk.

Section 33 of SARA prohibits the damage or destruction of the residence of a species at risk. Redds used for spawning by iBoF salmon are considered to be a 'residence'.

A forthcoming Critical Habitat Order will trigger a prohibition against destruction of any part of the species' critical habitat pursuant to subsection 58(1) of SARA. The prohibition against destruction of critical habitat in SARA 58(1) applies to all human activities within or outside of the critical habitat that result in a critical habitat function being made unavailable at a time when it is required by the species.

If destruction of critical habitat is likely to occur, the human activity is managed according to the DFO SARA guidelines for permitting. The permitting regime sets out the process for DFO to manage the section 58(1) prohibition against destruction of critical habitat and the general prohibitions of SARA (section 32) and SARA section 73 conditions in its management of human activities that have the potential to contravene the prohibition against the destruction of critical habitat. However, given that protection of critical habitat is a legal obligation, in cases where enough habitat information is available, DFO manages habitat identified as necessary for the survival and recovery of a listed species according to the section 73 conditions even prior to initiating legal protection or recovery planning. This is a precautionary approach used to ensure survival and recovery of the species.

The 2010 recovery strategy for the iBoF salmon included a description of critical habitat in the freshwater portion of their habitat, in the Gaspereau, Stewiacke, Debert, Folly, Great Village, Portapique, Economy, Upper Salmon, Point Wolfe and Big Salmon rivers. Efforts are currently underway to identify additional critical habitat in estuarine and marine areas. These areas are projected to be identified in an amended recovery strategy and protected via a Critical Habitat Order.

Canada National Parks Act

Protection to iBoF salmon habitat is also offered by the *Canada National Parks Act* and its regulations for the portion of iBoF salmon habitat that falls within the Fundy National Park of Canada (i.e., those portions of the Point Wolfe and Upper Salmon rivers within the park boundaries). A description of the critical habitat located within Fundy National Park of Canada was published in the *Canada Gazette* on November 5, 2010, pursuant to subsection 58(2) of SARA.

Fisheries Act

IBoF Salmon is part of a commercial, recreational or Aboriginal fishery. The *Fisheries Act* and its supporting regulations (the *Fishery (General) Regulations*, *the Maritime Provinces Fishery Regulations,* the *Atlantic Fishery Regulations, 1985*, and the *Aboriginal Communal Fishing Licences Regulation*) provide the tools to protect, conserve and manage fisheries.

The *Fisheries Act* has specific provisions that:

a. on the Minister's request, require the owner or person who has the charge, management or control of an obstruction or any other thing that is harmful to fish, to ensure the free passage of fish or prevent harm to fish from obstructions (section 20);
b. prohibit any undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery, unless authorized (section 35). Serious harm to fish is defined as the death of fish or any permanent alteration[3] to, or destruction[4] of, fish habitat;
c. prohibit the deposit of deleterious substances into waters frequented by fish unless regulated (section 36); and
d. on the Minister's to request, require procedures, schedules, analyses, samples, evaluations and other information to determine whether a work, undertaking or activity results or is likely to result in any serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery (section 37).

Under the regulations:

a. commercial, recreational and Aboriginal Atlantic salmon fisheries have been closed since 1990 on all iBoF rivers except for the Gaspereau River. The Gaspereau River remained open for Atlantic salmon recreational and food fisheries until 1994, was closed in 1995 and re-opened with limited food fishery agreements and a shorter catch-and-release angling season in 1996 and 1997;
b. the retention of incidentally caught salmon is strictly prohibited; and,
c. it is illegal to release live fish into fish habitat without a federal licence. This is to minimize disease, genetic, ecological or other adverse effects to wild fish and their habitat(s).

All commercial fisheries for Atlantic salmon in the Bay of Fundy were closed after the 1984 season. Recreational fisheries for Atlantic salmon in iBoF rivers were reduced in the years following the closure of the commercial fishery and subsequently closed since 1990 except for the Gaspereau River. The Gaspereau River remained open for recreational and food fisheries until 1994, was closed in 1995 and re-opened with limited food fishery agreements and a shorter catch-and-release only angling season in 1996 and 1997.

2.5.2 Provincial authority

The provinces have exclusive legislative authority over matters dealing with property and civil rights and the management of public lands, including those pertaining to public fisheries, water and substrates. In

[3] A permanent alteration to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes.

[4] The destruction of fish habitat of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes.

both NS and NB the control of water rights are also areas of provincial responsibility. With respect to ownership of the riverbed, in NS and NB it is asserted to be owned by the crown (the province); however in NB, private landowners claim to have been granted riparian rights. The provinces regulate the terms and conditions of access to the recreational fisheries in freshwater. Similarly, the granting of special privileges to limit access to certain waters falls under provincial jurisdiction.

NB and NS also have legislation regarding environmental protection, land use, riparian rights associated with water quantity and water quality, forest management, mining, aquaculture development, agriculture, and highway and infrastructure development.

The NB Department of Natural Resources, the NS Department of Fisheries and Aquaculture and the NS Department of Natural Resources administer their respective provincial natural resource management legislation and also support the federal *Fisheries Act*. Both provinces have environmental agencies (NS Department of Environment, NB Department of Environment) for delivery of their environmental legislation. Examples of provincial legislation that directly and indirectly afford protection to iBoF salmon in NB include the provincial *Species at Risk Act*, *Aquaculture Act*, *Clean Environment Act*, *Clean Water Act*, *Ecological Reserves Act*, *Crown Land and Forests Act*, *Pesticide Control Act* and the *Fish and Wildlife Act*; and, in Nova Scotia, the *Endangered Species Act*, *Fisheries and Coastal Resources Act*, *Wildlife Act*, *Environment Act* and *Angling Act*.

New Brunswick

The provincial *Species at Risk Act* lists the iBoF salmon as an endangered species; however, the legislation does not provide an automatic prohibition against habitat destruction.

The *Clean Water Act* was established in 1989 and houses many of the most important pieces of provincial legislation related to protecting the quality and quantity of the waters in rivers, streams and lakes that underpin the diversity of aquatic habitats and species, recreational opportunities and drinking water supplies. Key regulations for the protection of surface water include the *Watershed Protected Areas Designation Order* (2001) *Water Classification Regulation* (2002), and the *Watercourse and Wetland Alteration Regulation* (1990). Ground water drinking supplies are regulated by the *Potable Water Regulation* (1993) the *Water Well Regulation* (2002). The *Water Quality Regulation* under the *Clean Environment Act* prohibits, without permit, the pollution of any waters in the province.

Fish and Wildlife Act: The Department of Natural Resources and Energy has a proprietary responsibility to protect fish and wildlife by virtue of the legislation contained in section 3(1) of the *Fish and Wildlife Act*.

Nova Scotia

The *Fisheries and Coastal Resources Act* is the primary piece of legislation for the NS Department of Fisheries and Aquaculture. This Act provides authority for most of the Department's functions and activities including the ability of the Minister of Fisheries and Aquaculture to issue, terminate, and impose terms and conditions on aquaculture sites (licences and leases).

The *Wildlife Act* provides for the regulation of hunting and fishing and the possession and sale of wildlife.

The *Environment Act* supports and promotes the protection, enhancement and prudent use of the environment. It prohibits the release of a substance that causes or may cause an adverse effect, unless

authorized by an approval or the regulations. The *Activities Designation Regulations* require approvals for watercourse alterations. The *Environmental Assessment Regulations* require any undertaking that may disrupt two or more hectares of a wetland to be registered with NS Environment.

The *Water Resources Protection Act* regulates the removal of water from any of the province's drainage basins and prohibits the bulk removal of water.

The *Forests Act* helps to maintain or enhance wildlife and wildlife habitats, water quality, recreational opportunities and associated resources of the forest. It ensures that wildlife, wildlife habitats and the long term diversity and stability of the forest ecosystems, water supply watersheds and other significant resources are managed appropriately. The *Wildlife Habitat and Watercourses Protection Regulations* are specific to forest harvesting and specify that forestry operators must ensure the establishment of a special management zone of at least 20 m in width along the boundaries of watercourses. The regulations are applicable on all lands regardless of ownership.

2.6 Conservation Measures

Existing conservation measures were examined to determine the extent to which they mitigate threats to the survival and recovery of the iBoF salmon. Should marine survival return to healthier, pre-mid 1980s levels (e.g., the Big Salmon River population was in the range of 1,000 to 4,000 salmon), then impacts to freshwater habitat that affect the productive capacity of iBoF salmon (e.g., rate and level of smolt production) will become the dominant factors in their recovery (DFO 2008, 2010). For this reason, recovery actions need to address both regional marine and freshwater threats to iBoF salmon populations.

The proposed action plan (DFO 2016) for iBoF salmon outlines 35 recovery measures that address all the recovery objectives of the 2010 recovery strategy, including measures to identify and remedy threats in both the freshwater and marine environments.

The Live Gene Bank (LGB) Program

Live Gene Banks (LGBs) have been established for the iBoF salmon for over 15 years (initiated in 1998) in NB and NS. The purpose of this program is to maintain the potential for iBoF salmon recovery by preserving the genetic base thought to be representative of the populations. The LGB program has been used to maintain the persistence of iBoF salmon to date, and a plan to continue for a further five years is currently under development (DFO 2016). The program will, however, continue to be periodically reviewed and re-evaluated, with adjustments made as appropriate to accommodate new information and changing conditions.

The LGB program is currently focused on four rivers: the Stewiacke and Gaspereau in NS, and the Big Salmon and Point Wolfe in NB. LGB fish have also, however, been released into the Upper Salmon, Weldon Creek, Demoiselle, Petitcodiac, Black, Economy, Great Village, Debert, Folly, Salmon (Colchester), Cornwallis, and Portapique rivers.

Efforts to identify and remedy threats in the marine environment

Efforts to date have involved a range of activities, including literature reviews and field studies to determine the marine habitat quality, quantity and use by iBoF salmon populations, and surface trawling surveys and acoustic tagging experiments of post-smolts to determine their distribution during fall and winter months at sea. Other studies are focused on developing electronic tags and tag release

mechanisms to extend the range of data that can be collected from these types of projects, and analysis of historical scale patterns as a means of detecting changes in environmental conditions or migration patterns.

The advice summarized in DFO's 2013 report is being used to inform the identification of marine and estuarine critical habitat in an amended Recovery Strategy. The 2013 report provides information on the important biophysical functions, features, and attributes of each relevant iBoF salmon life-history stage. In the marine and estuarine habitat of iBoF salmon:

- Important functions are migration, feeding, and staging;
- Important features are migration corridors, estuarine holding pools, surface waters, upwellings, and food availability;
- Important attributes of these features include temperature, salinity, water flow, depth/volume, forage species, (e.g. sandlance, herring, euphausiids, amphipods), and predator abundance.

Efforts to identify and remedy threats in the freshwater environment

Several studies have been undertaken to date to provide information on iBoF salmon freshwater habitat use, quality, and quantity (DFO 2010). Stream habitat slopes have been classified and mapped in a Geographic Information System (GIS) format for 23 iBoF rivers; a study on the habitat use by juvenile salmon has recently been completed; and tracking experiments have clarified habitat needs for juveniles and adult spawners. Other work documenting other types of habitat and use by iBoF salmon is underway and includes the development of a habitat survey database for juvenile Atlantic salmon in the Memramcook River and adjacent tributaries, culvert surveys and stream experiments to determine the effects of nutrient enrichment.

Ongoing freshwater habitat restoration activities will also contribute to achieving the objectives and goals of this recovery strategy and efforts are regularly undertaken by government agencies and interested stakeholders.

Additional projects underway include a trial of the upstream migration of adult salmon to the White Rock fishway on the Gaspereau River under controlled flow conditions, an inventory of culvert installations within the Maritimes region of DFO and subsequent development of guidelines for their installation, and the assessment of the 243 aboiteaus within NS iBoF watersheds.

3.0 Assessment

3.1 Population and Distribution Objectives

The overarching recovery goal for iBoF salmon is "*to re-establish wild, self-sustaining populations as required to conserve the genetic characteristics of the remaining iBoF salmon*" (DFO 2010). The population and distribution objectives established in the species' recovery strategy set out the basis for achieving a recovered state for the species. Creating and maintaining the necessary conditions to conserve the genetic characteristics of iBoF Salmon and re-establish wild self-sustaining populations will be accomplished by implementing these objectives (DFO 2010).

The population and distribution objective in the short term is to progress towards re-establishing self-sustaining populations to their conservation levels in the following 10 river systems that contribute to the LGB program: Gaspereau, Stewiacke, Debert, Folly, Great Village, Portapique, Economy, Upper

Salmon, Point Wolfe and Big Salmon. These are the rivers that have also been identified as critical habitat for iBoF salmon in the species' recovery strategy.

The longer-term target for recovery, should marine survival increase, is to re-establish self-sustaining populations of iBoF Atlantic salmon to a conservation level of 9,900 spawning adults distributed throughout the following 19 river systems: Gaspereau, Shubenacadie, Stewiacke, Salmon (Colchester), North (Colchester), Chiganois, Debert, Folly, Great Village, Portapique, Bass (Colchester), Economy, Harrington, Apple, Maccan, Petitcodiac, Upper Salmon, Point Wolfe and Big Salmon. This target recognises that once marine survival rates for iBoF salmon improve, recovery efforts in a greater number of rivers will become increasingly valuable for long-term population self-sustainability. There are no timelines associated with this target.

3.2 DFO Project Assessments

DFO directs all proponents of projects affecting iBoF salmon to apply for an authorization under SARA and, if applicable, the *Fisheries Act*. Under section 73 of SARA, the Minister of Fisheries and Oceans may only authorize a person to engage in an activity affecting a listed aquatic species, any part of its critical habitat, or the residences of its individuals under certain conditions. Included among these conditions (sub-section 73(3)) is that the competent minister is of the opinion that:

> a) all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted;
> b) all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals; and
> c) the activity will not jeopardize the survival or recovery of the species.

DFO carries out regulatory reviews under the *Fisheries Act* of all projects that have the potential to result in serious harm to fish. The review of any proposed project also takes into consideration whether it complies with SARA, a process that is already well established in both NS and NB.

DFO has arrangements with provincial governments, who conduct an initial review of projects in freshwater, marine and coastal environments under their respective jurisdictions, to determine whether they require advice or DFO review under the fisheries protection provisions of the *Fisheries Act*.

In addition, DFO participates in the NS and NB Watercourse Alteration Regulatory Programs. For example, in NS, watercourse alteration permits are issued under a joint review process. A Canada-Nova Scotia Memorandum of Understanding on Fish Habitat Management facilitates a collaborative approach to the conservation, protection and enhancement of fish habitat. Neither of the above-mentioned specific projects occurs within the areas currently identified as iBoF salmon critical habitat; however, they are within areas identified as important marine and estuarine habitat for iBoF salmon (DFO 2013).

DFO's reviews of these projects took into account the potential impacts on SARA-listed species, including iBoF salmon.

Alton Natural Gas Storage Project

Nova Scotia Environment conducted an environmental assessment of the project and issued an environmental assessment approval in 2007. DFO, along with other federal and provincial departments, provided expert advice on the potential impacts of the project and adequacy of the proposed mitigation. The Department provided expertise in fish life histories, including Atlantic salmon, as well as technical

advice on mitigation and monitoring to ensure there are no impacts to fish and fish habitat. Mitigation and monitoring in place to reduce potential impacts to iBoF salmon include: ensure salinity is no greater than 7 parts per thousand (ppt) (to a maximum of 28ppt) at 5 metres from the diffuser during smolt migrations; monitor the salmon's use of the mixing channel in the first year of operation; monitor the intake structure for entrainment of any fish species; and monitor salinity levels at the entrances to the mixing channel and within the river to ensure levels remain within background limits.

DFO determined that the project is unlikely to cause 'serious harm to fish' as there would be no destruction or permanent alteration of fish habitat or the death of fish (from physical impacts such as entrainment), therefore an Authorization under section 35(2)(b) of the *Fisheries Act* was required. The project was also assessed for potential impacts to iBoF salmon, the only SARA-listed species near the project site. The pathways of effects included exposure to brine (higher than normal salinity) and entrainment at the intake structures. These potential effects could impact only migrating adults and smolts as there is no spawning or rearing habitat near the project site.

The potential to exposure to higher than normality salinity was considered moderate as it is possible for a salmon (adult or smolt) to move through the mixing channel. However, given that fish are known to be able to detect changes in salinity, salmon may avoid the mixing channel. If, however, a salmon were to move through the mixing channel the exposure to high salinities (5 metres from the diffuser) would be extremely brief (estimated at 5 to 7 seconds) as brining only occurs during the tide. Toxicity testing of juvenile Striped Bass at only 3.5 millimetres in length did not experience mortality until after several minutes of exposure to brine levels as high as 100 ppt. Therefore, no mortality of salmon smolts at 71 to 76 centimetres is expected, given the length of possible exposure.

Concerns were raised that the introduction of brine could impact the homing ability of salmon during their migration. However, the brine will represent less than 0.009% of the overall river flow, and although it is possible for salmon to detect these low-level changes, it is unlikely to impact migration as salinity levels in the river fluctuate from 0ppt to 28ppt.

The project requires 10,000 cubic metres per day or 0.12 cubic metres (120 litres) per second. The intake surface area of the gabion wall ranges from 244 square metres to 52 square metres depending on the tidal level and river flows. This large surface will allow enough water to gravity feed through the wall to provide the needed volumes for the intake pipe. The maximum velocity predicted at the site is 0.0056 metres per second (m/sec) and the escape velocity for fish such as a salmon smolt is 0.11 m/sec. The intake velocities are therefore well below the escape velocity of a salmon smolt, and it is unlikely that any salmon would be entrained in the intake structure.

A Nova Scotia Environment approval to operate the brine pond was issued on January 21, 2016, and the conditions of approval include river site monitoring and mitigation plans reviewed by DFO. Atlantic salmon smolt acoustic tagging will be conducted to determine whether they use the constructed mixing channel in the spring of the first year of operation. Salinity levels will be monitored to ensure that they are within acceptable limits. DFO will continue to provide expert advice on monitoring results to ensure the measures put in place by the proponent are effective in mitigating all impacts to fish species, including iBoF salmon, found near the project area.

Fundy Ocean Research Center for Energy

Since 2005, DFO has been engaged in the review of several environmental assessments to predict potential environmental effects associated with tidal power development in the Bay of Fundy and has also been involved in a number of studies to better understand potential effects on the marine

ecosystem. Most recently, DFO has been involved in the review of environmental effects monitoring programs (EEMPs) associated with the proposed installation of tidal turbines in the Minas Passage. Departmental scientists have also reviewed baseline studies and proposed monitoring programs provided by FORCE and Cape Sharp Tidal. The department provided recent advice on the EEMPs proposed by Fundy Ocean Research Centre for Energy (FORCE) and Cape Sharp Tidal Venture, the proponents of these projects, and recommended the development of further studies and an expanded monitoring program.

In 2015, DFO reviewed the potential for 'serious harm to fish' from the installation and intended 15-year operation of two turbines. Impacts to fish and fish habitat were considered from both the installation and operation of the turbines. As a result of installation (including construction, maintenance, decommissioning) of the turbines, impacts to fish and fish habitat could occur from three stressors: collisions with vessels; noise/disturbance from vessels and machinery; and physical alteration of habitat. As a result of operation of the turbines, impacts to fish and fish habitat could occur from five stressors: collisions, including strikes with device components, entrapment in cables and other structures; noise/vibrations emitted from devices; electromagnetic fields emitted from power output cables; presence of artificial structures; and reduction of current energy.

The review concluded that no residual serious harm to fish is expected to occur from the installation or operation of the turbines[5]. Relative to the amount of similar habitat available in the local area, the geographic scale of impacts is very low. The vessels and equipment used to install, construct, maintain and decommission the turbines, as well as the impacts caused by them will be very small relative to the area in which they will be operating. The installation and operation of the turbines is also not expected to impact the availability or condition of nearby fish habitat. In the immediate vicinity, habitat type is similar or identical to that of the area where the turbines would be installed. It was also concluded that given the relatively slow speed of the turbines (7 to 10 revolutions per minute) and monitoring of similar devices in other countries which showed no impacts to fish, that there would be no direct impacts from the devices on iBoF salmon. It is also predicted that any other possible effects of the devices (entrapment in cables; noise or vibrations; electromagnetic fields; presence of artificial structures; and reduction of current energy) would be limited in scale with the deployment of these two turbines, and that they would not have any impact on salmon migration through the area. Therefore the placement of these two devices in the Minas Passage is not expected jeopardize the survival or recovery of iBoF salmon.

3.3 Conclusion

An Emergency Order may identify habitat that is necessary for the survival or recovery of the species. The 2010 recovery strategy for the iBoF salmon included a description of critical habitat in the freshwater portion of their habitat. A Critical Habitat Order is already in development for these areas. Efforts are currently underway to identify additional critical habitat in estuarine and marine areas, which will be identified in an amended recovery strategy and which will also be protected via a Critical Habitat Order. These processes are expected to take place within a timeframe that will avoid irreversible harm to the population.

An Emergency Order may include provisions requiring the doing of things that protect the species and that habitat, or provisions prohibiting activities that may adversely affect the species and its habitat.

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[5] After efforts have been made to avoid and mitigate impacts, any residual serious harm to fish would have to be addressed by offsetting.

Threats to the iBoF salmon's survival or recovery from the two specific projects outlined above are already being addressed through the implementation of ongoing conservation and recovery measures and the existing regulatory framework. DFO carried out regulatory reviews under the *Fisheries Act* of the above-mentioned projects and took into consideration whether the project activities would comply with SARA. In both cases, it was concluded that the potential for impacts to iBoF salmon and salmon habitat are not significant and should not impede the population and distribution objectives for the recovery of iBoF salmon from being attained. DFO is currently not aware of any planned or ongoing activities that would need to be mitigated beyond the requirements of existing legislative or regulatory regimes.

The survival of the iBoF salmon is currently maintained through continued monitoring and the LGB program.

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